

**THE GENETICS OF THE MELANIC AB. *NIGRICANS* CULOT OF  
*MELANARGIA GALATHEA* L. (LEP.: NYMPHALIDAE: SATYRINAE)**

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IN SOME PARTS of its Southern European range the colour pattern of *M. galathea* is rather variable with a tendency towards melanism. Indeed, in certain areas melanic forms may predominate and examples occur in which the white ground colour is entirely obscured by black scaling. However, in England and Wales the colour pattern of the species is so remarkably consistent that specimens demonstrating any significant departure from the typical form have always been regarded as considerable rarities. A very few extreme aberrations have occasionally been recorded which are largely, or wholly, either white or black. However, there are other, somewhat less extreme aberrations, that have occurred as recurrent forms in certain localities.

R.M. Craske records that ab. *craskei* Tubbs occurred in two separate locations, in Hampshire and Sussex, at a frequency of between one aberration in twenty butterflies to one in fifty (Tubbs, 1978). N.A. Watkins (1958) reported the frequency of ab. *valentini* Williams (illustrated in Williams, 1951) in a Somerset colony to be somewhere in the order of one aberration per thirty butterflies. A.E. Collier found six specimens of ab. *aperta* Rebel in a Northants colony between 1948 and 1951 (Collier, 1954) and R. Pilcher also found an example in 1948. After 1951 the colony became reduced in size and no further specimens of this form were found. Collier bred this form and these were exhibited, with comments, at the exhibitions of the South London Entomological and Natural History Society in 1952 and 1953 (Collier 1952 and 1953).

Each of these aberrations has been bred and, as expected, all proved to have a genetic basis. Both *craskei* (*vide* Revels 1980) and *aperta* (*vide* Collier, 1954) are inherited as semi-dominants. Ab. *valentini* has only been reared to the first generation but the results also suggest either a semi-, or a full, dominant condition (Watkins 1959). Breeding experiments have shown that while certain aberrations of British Butterflies are inherited as semi- or complete dominants over the typical form, nevertheless the recessive or multifactorial modes of inheritance are far more frequent.

Ab. *nigricans* Culot is a fourth aberration that comes into the category of a recurrent form, although it was always far less frequent than either *craskei* or *valentini*. It is described (Emmet and Heath 1989, illustrated at Pl. 18 fig. 5) as having "the post discal black markings greatly extended". In fact this is only a partial description because the extension of black markings occurs in the discal areas also, albeit less dramatically. The underside of the forewing, however, is invariably typical except for a slight reduction in size of the white discal area.

Earlier this century *nigricans* was found, from time to time, in certain localities in the Gloucestershire/Somerset region. The captured specimens were generally rather minor developments of the form, but at least two striking specimens are known, for

example the male specimen illustrated in Emmet and Heath (*op. cit.*). To my knowledge, this form was last recorded by N.A. Watkins around the mid-1960's. Since that time the inevitable loss of, or change in, habitat has reduced populations of *galathea* in these areas. It seems that, like *aperta* after 1951, *nigricans* disappeared as the colonies reduced in size.

Over the course of 13 years I have spent considerable time working colonies of *galathea* over a very wide area in this district in the hope that *nigricans* might one day recur. I hoped to find a female specimen to breed from to discover whether this aberration too is inherited as a dominant over the type form.

A few locations in the region seemed to have all the attributes necessary for the production of really large populations of *galathea* should the optimal conditions of weather and grazing coincide. However, even in years when the populations were fairly good, the search for *nigricans* proved quite fruitless so I had come to assume that this form was lost. However, in 1997 one of these locations finally obliged with a sudden, unexpected and enormous increase in numbers. The population may easily have numbered several thousand butterflies, spread out over a rough grassy slope. Close searching of this colony in previous years had revealed no signs of *nigricans*. Nor did it in 1997 until, towards the end of one warm, still day I was walking from the bottom of the slope up one edge of the area, though long grass full of *galathea* basking in the evening light, when I was delighted to spot a female *nigricans* sunning herself on a knapweed flower alongside two typical males. Several examples of both sexes were subsequently captured during the rest of the flight season, though only from this small section of the colony. No example was extreme, but these aberrations stood out clearly in the field amongst the abundant typical form.

Two females were kept for breeding and, despite having to travel with me to the Outer Hebrides, they laid a total of about 200 of the hard, white and spherical eggs so characteristic of the species. They were ejected quite randomly from some perch in the cage and could be heard bouncing on the cardboard base. The butterflies fed a great deal from flowers, being particularly fond of Red Valerian *Centranthus ruber* L., but they seemed quite uninterested in the cotton wool soaked in honey water that is such a good food source for some captive butterflies. Thirty-one adults emerged in June 1998, consisting of 16 males (eight typical and eight *nigricans*), and 15 females (seven typical and eight *nigricans*). The brood ratio therefore was almost precisely one type : one *nigricans*. A number of the strongest aberrations of each sex were paired and although, like their parents, they were required to travel outside their natural range (this time to Western Ireland), they laid a total of 400-500 eggs.

A third of the eggs subsequently collapsed, but the larvae which hatched from the rest followed the pattern of the first generation in showing an excellent rate of survival up to September/October, followed quickly by heavy losses. By mid-October these larvae were dying so fast that I cleared all that remained from the pots and brought them indoors in an effort to force them through. They were put on cut grass in warm, dry conditions and given a long daylength regime (18 hours light: six dark; provided by daylight-balanced strip lights). Losses initially continued at such a

rate that half of the 110 larvae died in just two weeks. By 7 January only 23 were left, but the losses had stopped. I suspect that bringing the larvae through in this way may have prevented the total loss of this valuable brood.

The F2 brood of 23 butterflies was made up of seven females (two typical and five *nigricans*) and 16 males (four typical and 12 *nigricans*). The *nigricans* could be clearly separated into the heterozygous and homozygous forms. The final ratios of the brood were:- six type: nine heterozygous *nigricans*: eight homozygous *nigricans*. This is close to the classic 1:2:1 ratio that would be expected of a semi-dominant form, so confirming that *nigricans*, like the other aberrations of the species that have been bred, demonstrated dominance over the typical form.

Homozygous forms of *nigricans* are illustrated in Plate B and heterozygous examples of varying intensity in Plate C. Given the rarity in the field of the heterozygous form of *nigricans* it is unlikely that the homozygote form has ever been seen. Certainly the author is unaware of any museum specimens. The accompanying photographs show that the homozygote has a characteristic that clearly separates it from the heterozygote; this is the almost total suffusion of the forewing discal cell by black scaling, leaving just a tiny streak of white scales. Other areas of the wing pattern are also far more heavily melanised in the homozygote than the heterozygote, but none in so consistent a manner as to allow for clear differentiation between the two.

The fact that all four bred aberrations of *galathea* have turned out to be dominant over the typical form is an interesting finding given the relative rarity of the dominant condition amongst aberrations of British Butterflies. At present the significance of this, if any, is obscure, though an exception to a general trend is often likely to provide a fruitful line of study. Perhaps further research into the environmental conditions under which the pale and dark forms of *galathea* occur on the continent, along with some knowledge of their genetics and ecology may, when compared to these British aberrations, throw some light on the matter.

#### References:

- Collier, A.E., 1952. Report of exhibit at Annual Exhibition of 1952. *Proc. S. Lond. ent. nat. Hist. Soc.* 1952-3
- , 1953. Report of exhibit at Annual Exhibition of 1953. *Proc. S. Lond. ent. nat. Hist. Soc.* 1953-4
- , 1955. A note on *Agapetes (Melanargia) galathea* L. ab. *aperta* Rebel. *Entomologist's Rec. J. Var.* 67: 1-5
- Emmett, A. Maitland and Heath, J. (eds), 1989. *The Moths and Butterflies of Great Britain and Ireland*. Harley Books.
- Revels, R.C., 1980. Notes on breeding the Marbled White Butterfly: *Melanargia galathea* ab. *craskei*. *Entomologist's Rec. J. Var.* 92: 57-60
- Russwurm, A.D.A., 1978. *Aberrations of British Butterflies*. Classey
- Tubbs, R.S., 1978. The breeding of butterflies with special reference to the genetics of aberrational forms. *Proc. Br. ent. nat. Hist. Soc.* 1978 pp.77-88
- Watkins, N.A., 1958. Report of exhibit at Annual Exhibition of 1957. *Proc. S. Lond. ent. nat. Hist. Soc.*, 1958
- , 1959. Report of exhibit at Annual Exhibition of 1958. *Proc. S. Lond. ent. nat. Hist. Soc.*, 1959
- Williams, H.B., 1951. A new aberration of *Melanargia galathea* L. *Entomologist's Gaz.* 2: 247-249.